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be inscribed on the roll of the worthies of the nation. He had seen his country grow from comparative feebleness to a great power, and he had had a share, not only in influencing its political tendencies, but in determining its moral ideals. The last was his more important work. and it is as a poet who gave appropriate, elevated, and refined expression to the moral sentiment of the community that he will be chiefly remembered. His verse bears the stamp of New England. It is the outcome of the grave piety, the sober joys, the reflective seriousness, of the elder mood of the country. In this sense it belongs rather to the past than to the present; but the truth and felicity with which they express common and natural feelings and emotions will secure to the most widely known of Mr. Bryant's productions a permanent place in the pages of the household book of American poetry.

It is not needful here to give even a summary of Mr. Bryant's biography. This work has been done well where it might be done more appropriately. For his intellectual activity displayed itself chiefly outside the fields cultivated by this Academy. It is required only of us to bear our testimony of honor to the memory of a poet and public servant, who, born in Massachusetts, has, at his death, been claimed by the nation for its own.

JOSEPH HENRY.*

Joseph Henry, who was united with this Academy as an Associate Fellow on May 26, 1840, was born in Albany, N. Y., on December 17, 1799, and died in Washington, D. C., on May 13, 1878, in the plenitude of his years, his labors, and his honors. The child is always father to the man: but there was nothing in the childhood or youth of Henry to proclaim the advent of one whose life would be a blessing to mankind, and whose death would be felt as a nation's loss. Descended from Scotch ancestors, who had recently emigrated to this country, and losing his father at an early age, he passed a large part of his youth under the care of his maternal grandmother, at Galway, in Saratoga County. Here he attended the district school until he was ten years old. Then he was taken into a store, where he was treated kindly and allowed to be present at the afternoon session of the school. Obtaining access to the village library, at first by accident, afterwards by stealth, and finally by permission, he revelled in an ideal world of fiction, and perhaps cultivated, unconsciously, that faculty of imagination which served him as the interpreter of Nature.

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* The death of Professor Henry, although reported last year, took place so near the time of the annual meeting, that this notice was necessarily deferred until the present Report.

At the age of about fifteen Henry returned to Albany and entered a watchmaker's shop as an apprentice. Whatever knowledge of mechanism and delicacy of touch were thus acquired were not thrown away upon one destined to plan and handle the nice appliances of physical research. And yet his heart was not in the new occupation. The stage, before the scenes and behind the scenes; private theatricals; a club of amateurs of which he was president, and for which he wrote and acted tragedy and comedy, — absorbed his time and thoughts. All who have seen and admired the refined, intellectual face, and the erect, dignified form of the ripe philosopher, can easily imagine the success of the young aspirant for dramatic distinction when these charms of person and mind were decked in the beauty of youth: the self-possession, the repose, and the grace of this expounder of physical science alone remained to tell of his short-lived eccentricity. Those readers who allow the mythical apple to divide with Newton the glory of a great discovery will listen eagerly to the statement that the theatrical career of young Henry was suddenly arrested by his accidental encounter, during a brief illness, with Dr. Gregory's popular lectures. The literal truth of the story is not questioned; for Professor Henry himself believed it, and reverently cherished the precious volume to the last. Such, however, was the occasion, but not the cause, of his dedicating himself henceforth to science. Innumerable accidents of a similar kind happen to every one, but not with the same result. Man, especially such a man, is not the creation of any accident. The inspiration comes from within: it is the unbidden thought, and not the external events with which it is associated. Said a great divine, "If you say that man is the creature of circumstances, it must be with the understanding that the greatest and most effective of these circumstances is *the man himself.*"

Bidding farewell to the stage and his theatrical companions, Henry went seriously to work to complete his education; at first in an evening school, then with an itinerant pedagogue, and finally in the Albany Academy, where he was both pupil and teacher. Next he was private tutor in the family of the patroon, devoting his leisure to the study of mathematics, and subjects which would fit him for the medical profession. In 1826 he made, in connection with Amos Eaton, the survey for a road across the State of New York. In this work he displayed so much energy and ability that his friends hoped to find, or to create for him, a permanent position as engineer. But the State failed to respond, and Henry returned to the Albany Academy as assistant teacher, and in 1828 as Professor of Mathematics.

Only a few years had elapsed since the science of electricity had taken a new departure under the name of electro-magnetism. Oersted, of Copenhagen, had kindled the flame, which passed rapidly from hand to hand among the scientific workers of Europe, until it culminated in the splendid generalization of Ampère. This western continent may have been tardy in welcoming the bright light in the east, but the response, when given, was not a fire, but a conflagration. Professor Henry led in the new line of physical research with a self-born enthusiasm which seven hours of daily teaching in mathematics could not extinguish or cool. The limits of this notice forbid a lengthened statement of his contributions to electro-magnetism. But the fertile principle which he deduced from his experiments must not be passed over in silence. His distinction between *quantity* and *intensity* magnets, and between *quantity* and *intensity* batteries (though now differently expressed), is all-important and of manifold applications. Every experiment with electro-magnetism, in the laboratory, in the lecture-room, and in the arts, is a success or a failure in proportion as this law is obeyed or ignored. If this discovery has linked Professor Henry's name with the telegraph especially, it is because that was the great problem of the hour, — unsolved, and as some supposed unsolvable. It is not easy to draw the dividing line between the merits of the discoverer and the inventor, when one follows closely upon the heels of the other. Professor Henry's contribution to the final triumph was large, and brilliant, and indispensable; but it was not all-sufficient. An alphabet was wanting; a sustaining battery must be invented; moreover, a man must appear with a capacity for business and a courage born of hope, with no original knowledge of the familiar laws of electricity but with an easy absorption of the science of other men, who, by a happy combination of experimental devices and the devotion of years, might finally achieve a grand commercial success. In view of Professor Henry's additional conquests in the realm of physical research, science will ever rejoice that he was not himself dazzled by the inviting prospect of riches and popular applause; that he renounced the fruits of invention when they were almost within his grasp; that he preferred to any short-lived, meteoric display the chance of shining for ever as a star in the upper heavens, with Agassiz, Cuvier, and Faraday.

Loyalty to the devotees of scientific research does not demand any disparagement of the usefulness or the genius of inventors. If the former enlarge the area of human knowledge, the latter contribute to the civilization of the race. If there are individuals in one class who think only of their pecuniary success, the other class is not without examples of those who mean to achieve, even if they do not deserve, a high scientific reputation. It is not incumbent on every scientific man to think, with Cuvier, that he must abandon a discovery the moment it enters the market, — that its practical application is of no concern to him. No one certainly has a better right to the fruits of this application than the discoverer himself. Inventors may sometimes stumble on good fortune; but the rich prizes are comparatively few, and, on the average, they are dearly earned by years of severe thought and anxious waiting. No graveyard holds so many buried hopes as the Patent Office at Washington. Since the first introduction of the telegraph, discovery and invention have advanced, hand in hand, over continents and through the ocean, leaving the world in doubt which to admire the most, — the conceptions of pure science, or the exquisite mechanism in which they are embodied. If on one occasion this harmony was disturbed by the repudiation of an indebtedness which had often before been freely acknowledged, the ingratitude was rebuked by the indignant voice of science, and the just claims of Mr. Henry were established on an impregnable foundation.

It does not detract from the merit or the originality of Professor Henry's early discoveries that the same ground had been covered by Fechner, in a work published in 1831, and that both had been anticipated by Ohm's experimental and mathematical analysis of the galvanic circuit, which dates back to 1827. For Ohm's little book of that date, which now shines as a foreland light for the guidance of all who explore in that direction, was known only to a few in Germany, and was unknown in France, England, and America at a time when, if known, it might have illuminated Professor Henry's researches. At a later period, Pouillet published the results of his own experiments, without knowing that he himself had been anticipated by Ohm. The father of Ohm had intended his son for a locksmith; but, unlike Henry, he did not even begin his apprenticeship. He pursued his studies to the verge of starvation; his heated brain worked while his body shivered before a fireless stove, often covered with ice. His book, which placed him before his death, in 1854, among the greatest of German physicists, was coldly received by his colleagues in the College of Jesuits, at Cologne. On the contrary, Professor Henry's recognition was prompt and sympathetic, at home and abroad; at a single bound he came to the front, and there he always remained.

In 1832, Professor Henry removed to Princeton to fill the chair of Natural Philosophy in the College of New Jersey. Here he found sympathizing associates, congenial duties, and the opportunity for original research. One year earlier Faraday, already widely known by his chemical discoveries, appeared upon the field of experimental electricity, and immediately became the most conspicuous figure thereon, the cynosure of admiring eyes in every land. His discovery of induced currents, and of the evolution of electricity from magnets, marked a new era in the science of electricity, elucidating facts which had defied the ingenuity of Arago, Herschel, and Babbage, creating the science of magneto-electricity as the correlative of electro-magnetism, and justly claiming for its last-born the splendors and wonders of the Ruhmkorff coil, the Gramme machine, and the telephone. Henry supplemented the work of Faraday by his own discoveries of the *extra*-current in the primitive circuit, and of induced currents of higher orders in as many adjacent circuits. He also succeeded where Faraday had doubts about his own experiments; viz. in obtaining unequivocal indications of similar induction in the momentary passage of electricity of high tension; proving also the oscillating discharge of the Leyden jar. Numerous experiments were made on induction by thunder-clouds, and on atmospheric electricity in general, by means of tandem-kites and lightning-rods.

Nobili and Melloni had widened and deepened the foundations of thermotics, unveiling new and intimate analogies between radiant light and heat, and enriching physical cabinets with many novelties, especially the thermopile and the galvanometer. Henry took advantage of the new instruments for measuring the heat of different parts of the sun. Secchi, the late astronomer and meteorologist of the Collegio Romano, distinguished as the foster-brother of Victor Emmanuel, but more as the gifted expounder of solar physics, owed his first inspiration in science, in his youth (for he died in 1878, at the age of fifty-nine), to Henry, whom he assisted in these experiments. Doubtless, other young men, if they could be heard, would confess to an equal enthusiasm for science, caught from the same high example. But the multitudinous productions which issued in rapid succession from the prolific brain and pen of Secchi, without the adventitious reinforcement of imaginary cases, justify and demand the assertion that what Henry led others to do is second only in importance to what he did himself.

More than fifty years ago, a little book was published under the fascinating title of "Philosophy in Sport made Science in Earnest." Of the many ingenious, complex, and costly instruments of research, has any one been richer in its revelations to science than the child's soap-bubble? But where the child saw only an evanescent display of colors, Newton read with mathematical clearness his celebrated theory of fits of easy transmission and reflection, and Young measured the constants of the undulations of light. To-day, the microscopic molar or molecular motions of the telephone-plate are translated into visible speech by the colors of a sympathetic film of liquid in the phoneidoscope. In 1844, Henry experimented with this ever ready minister to the delight and instruction of all ages, so beautiful but apparently so tender, and found that its cohesion and its contractile force were those of a giant if its own thinness were made the standard of measure. Thus was opened an avenue into the study of molecular action which Plateau has extended and embellished with the most varied and original experiments, not disheartened by the total loss of eyesight: finding by the way a beautiful experimental illustration of the cosmogony of La Place, and building architectural forms out of liquid films as if they had the cohesion of marble.

When, at the close of 1846, Professor Henry left the quiet walks of the Academy for a more public career in Washington, in obedience to the summons of the Regents of the Smithsonian Institution, though all applauded the wisdom of the choice, not a few regretted the sad interruption in his scientific life, already rich in performance and bright with the promise of more and perhaps greater discoveries. The sacrifice seemed to be too great to demand of science in a country where the taste and the mental qualifications, combined with the opportunity, for original research are rare. If Professor Henry had remained at Princeton, he would certainly have added other jewels to his crown: would it, however, have shone more brightly than it now shines? When posterity makes up its verdict on his claim to its gratitude and remembrance, his discoveries will not be counted, but weighed.

On the other hand, no friend of science can contemplate with complacency the possible alternatives if the Regents had come to a different choice, or if they had been defeated in their first selection. Literature or science; popular lectures or original research; the diffusion of old truth or the discovery of new truth; a national library, a national university, or a national museum, — each had warm and influential advocates. Professor Henry's plan of organization bears the date of December 8, 1847, and was adopted by the Regents on the 13th of December. It took its departure from the words of the founder, viz. *an establishment for the increase and diffusion of* *knowledge among men;* and it emphasized every word of the pregnant sentence. Not science in its restricted sense, but knowledge was to be first increased, and then diffused world-wide, — by the endowment of research; by the publication and liberal distribution of contributions to knowledge, which may have little value in the market, but which are of transcendent importance to man's culture and civilization; by elaborate reports in special departments, in which the known would be separated from the unknown for the benefit of new explorers; by the translation of writings otherwise inaccessible to most students; by opening a highway along which the current literature and science of the day could easily pass from continent to continent, and reach their remotest corners. This sober and catholic scheme, in literal fulfilment of the will of Smithson, was less dazzling to the popular imagination, and enlisted a smaller numerical support, than rival propositions which were more on the level of the average understanding. Because these antagonistic plans narrowed the enjoyment of a benefaction, (itself absolutely unfettered,) to a small community, they secured a local influence which threatened to defeat the comprehensive views of the Secretary. These views, recommended by their reasonableness and indorsed by individuals, academies, and societies of science and learning, had a tower of strength in the high scientific reputation and the weight of character of the Secretary himself. Winning and persuasive in his manner, he was inflexible in his purpose.

Experience has proved the truth of that which was the contention at the time ; viz. that universities, libraries, museums, lectures, because they confer local benefits, will never lack endowments, whereas the Christian world had waited eighteen centuries for a large-minded and large-hearted benefactor, whose bequest was all knowledge, existing or to be discovered, and whose recipients were all nations of men. Slowly but steadily time has revealed the wisdom and foresight of the Secretary; individuals and communities, in increasing numbers, have felt the benefits of his administration ; the government of the United States has known where to look for impartial advice on matters outside of its own knowledge, in times of prosperity and also in its darkest days; and now all opposition has died out; and, after a trial of thirty years, no one probably desires any thing better for the Smithsonian Institution than that the plan, so wisely conceived and so faithfully administered by the first Secretary, should continue the abiding rule for his successors.

Moreover, the plan of Professor Henry, cosmopolitan in its geographical embrace, did not sacrifice the interests of the unborn to those of the living. He would not allow the hopes of Smithson to be frustrated by lavishing upon a single generation what was intended for all time; or, what is worse, sacrificing both the present and the future upon the altar of an ambitious architecture. Examples abound, if experience is all which men need, of fatal shipwrecks on these alluring shores; of endowed churches, colleges, observatories, laboratories, libraries, which have nothing to show but a mass of masonry, lacking in the highest beauty of art, (fitness for its purpose,) however much it may please the eye, even if the merciless architect had left any thing for administration. The rigid rules of science, unqualified by good common sense, may work a disaster in matters of business. The consummate mathematician, La Place, omnipotent in the domain of physical astronomy, when appointed by Napoleon I. to a high office of state, attempted to carry the laws of the infinitesimal calculus into his administration, and failed. Not a few men of brilliant intellect, masters of thought and of the pen, have prided themselves on a childlike simplicity in the ways of the world. If Professor Henry had been one of these, much would have been forgiven to his honesty of purpose, to his love of truth, and to the success with which he had wooed her in her most secret recesses. Therefore, it is not the least of his triumphs that he did not, in imitation of an old astronomer, walk into a pitfall on this lower earth while gazing into the depths of space. He could roam with Emerson through the universe of thought, but the feet of both were firmly planted on the ground. Henry's judicious system of expenditures, so essential to the permanent prosperity of the Institution, put to shame the short-sightedness and the short-comings of many professed financiers; and exemplified, by anticipation, the magical products of the Holtz and Ladd induction machines, in which a trifling capital of well-invested electricity, the income of which is partly spent and partly saved, yields an ample return for the present, and by the law of compound interest secures still more brilliant results for the future.

When Professor Henry left Princeton, he knew, and his friends knew, that he must leave behind him the object of his highest ambition, viz. the undisturbed and the unostentatious study of the unfolding laws of the material universe. But he did not, and he could not, renounce the spirit of independent research which had made him what he was. As opportunity offered in the discharge of his official duties he manifested this spirit himself, and communicated it to others. His second report to the Board of Regents, for 1848, exhibits the promptness with which he had conceived, and begun to execute, the project of covering the United States, and eventually the North American continent, with a net-work of meteorological stations, which, with the facilities of the telegraph, yet in its infancy, would prove a perennial blessing to commerce and agriculture; and, by consolidating the scattered efforts of eminent meteorologists (among whom Coffin, Espy, Loomis, and Guyot were conspicuous), throw some light on the law of storms and meteorology in general. In the Patent Office Report for 1857, he gave his views of the relations between meteorology and agriculture. In this and other ways, the Smithsonian Institution has been a hot-bed for starting and nursing new projects in their days of infancy and weakness. After they have outgrown its accommodations and proved their usefulness, they have been adopted by the general government and transplanted to a richer soil.

For many years Professor Henry has been a conspicuous figure, not merely in scientific circles, but in the full view of the public; his name and his co-operation have been in constant demand. He naturally gravitated to places of honor which were often places of additional labor. Men of leisure have no time to give to occasional calls upon their public spirit. The hard-workers must also do all the extra work. Professor Henry was no exception to this rule. To the day of his death, he filled positions of trust and responsibility, with duties sufficient to crush an effeminate man. But they seemed to rest lightly upon shoulders which sustained, beside, the weight of a great institution. His mind was ever in a state of prolonged tension; but it kept its balance under these distractions, as do the rings of Saturn amid the multitudinous disturbances of its satellites. Often he waited for the leisure which never came to him when he might write out for publication scientific communications which he had made from a brief. He was President of the American Association at its second meeting, in Cambridge, in 1849. He gave the usual address of the retiring President at the fourth meeting, in New Haven, but it was not printed. He was Vice-President of the National Academy of Sciences in 1866, succeeded Dr. Bache as President in 1868, and died in office.

The most responsible and the most onerous of the gratuitous services which he gave to science and the country were rendered in his capacity of member of the Light-House Board, of which he was for seven years the chairman. The substitution of lenses for mirrors began the revolution in light-houses; but lens or mirror, without the light, is no better than a steam-engine without steam. To conquer prejudice by experiment, and save millions to the country by exchanging sperm oil for lard oil, is not so brilliant a service as the discovery of a new law of nature. But, more than any discovery, it makes science respected in high places, and enlists the sympathy of the unscientific community. There are times when sextants, chronometers, tables of the moon, and even light-houses, are of no avail, and an impenetrable veil of darkness shuts out the mariner from the lights of heaven and earth. But what is opaque to light may be pierced by sound. The experiments which have been made by Henry in this country and by Tyndall in England, in their official capacity, on the fog-penetrating power of the fog-horn, the fog-bell, the siren, the steam-whistle, and cannonading, have raised interesting questions in science, to which different answers have been given; but the facts remain, above controversy, to instruct governments in the best way of supplementing optical signals by acoustic signals. These last investigations of Professor Henry, to which, it is feared, he was a willing martyr, will always have a pathetic interest for those who knew and loved him.

It has been the aim of this notice to place in strong relief a few of the salient points in the intellectual life of Henry. Any statement in detail of the accumulations of his long life, in the way of experiment or deduction, must be very voluminous or very meagre. For he was not a concentrated specialist. His expanded thought swept the whole vast horizon of the physical sciences; not to speculate, but to discover. The severe discipline of science did not harden him against the fascinations of literature, poetry, and art.

It would be a delicate task, and premature, to attempt to assign to Henry his exact rank among those who have legislated for science in this and former centuries. There are laws of perspective in time as well as in space, whereby a small eminence seems to outclimb the distant Alps, and the present generation dwarfs apparently all its predecessors. Foreign countries and posterity will pronounce their irreversible verdict in this as in other cases. In his own country, and among his contemporaries, Mr. Henry was long and easily the acknowledged chief of experimental philosophers. If the earlier science of the country is passed in review, only a few names shine so brightly across the intervening years as to deserve any comparison with him who has recently departed. Winthrop and Rittenhouse in astronomy, Franklin in electricity, Rumford in thermotics, and Bowditch in mathematics, exhaust the catalogue of possible rivals. Of these, all but Winthrop were self-instructed, as was Henry, at least in what relates to their higher education. Of these, Franklin and Rumford, no less than Henry, were as remarkable in administration as in science; Franklin and Rumford from taste, and Henry from a sense of duty.

All three served their country well, — Franklin and Henry while living, and Rumford by his bequests. Winthrop, Rittenhouse, and Bowditch reached their exalted position by paths wholly untrodden by Henry. They cannot, therefore, be the standard for his measure. Rumford's mind was essentially practical, even in its science. He had more of the spirit of an inventor than a discoverer. In Henry's place he would have been more interested in pushing the telegraph to its final issue than in supplementing Faraday's laws of electro-dynamical induction. But in dealing with the heat of friction, Rumford displayed an experimental skill and a boldness of conception which have vindicated his claim to a high scientific position. The progress of recent discovery and the tendency of scientific speculation have promoted Rumford from the position which he long held, as leader of a forlorn hope, to the place of hero in the last act of the scientific drama. In this connection Henry's views on the correlation of the physical and organic forces may be recalled, which only lacked the fuller development and the wider publication which he finally gave to them, to have secured for him the first complete announcement of one of the grandest generalizations of modern science.

It might seem to be easy to institute a comparison between Franklin and Henry in reference to the value of their original scientific work, which was largely in the field of electricity. But a century has made great changes in the starting-point, the opportunities, and the resources of the discoverer. Franklin, with humble tools, had a virgin soil to cultivate. He had also the rare felicity, for which Newton also was envied, of living at a time when the scattered facts of a new science were waiting for a comprehensive generalization. If Franklin had made no experiments on the Leyden jar, or on the thunder-cloud, his theory of electricity, which has held its own to this day without any amendment (though its final doom is written upon it), would have secured for him a place second to no other among the worthies of science. Now the instruments of physical research are numerous and delicate; but useless unless the senses are educated to them. The literature of science is voluminous and in many languages. Success in scientific investigations demands now original thought, disciplined senses, scientific culture, and a well-chosen field, where the discoveries of other men will not be repeated. Both Franklin and Henry burned brightly in their allotted spheres, and in the future may differ only as one star differs from another star in glory.

The funeral services on May 16, 1878, proclaimed to the world that the republic had lost an illustrious citizen. There was no hollow pageant of empty carriages of state, but the highest and best in the land felt a personal bereavement. A patriotic and devoted servant of the government was dead; a bright light in science had gone out; a noble man, born to attract and to sway, in whom science was illuminated by faith, and faith was enlightened by science, lived on earth no longer except by his example; a long life, crowded with beneficent services to truth and to man, was closed. Not less affecting were the memorial exercises of January 16, 1879, in the hall of the House of Representatives, before the assembled wisdom and grandeur of the nation. Science may be proud of this spontaneous tribute to her favored child, if she only remembers that it is character which makes intellect a blessing and not a scourge to mankind, and awakens genuine sympathy and admiration. Mr. Henry was not the favorite and ornament of a court, but the peer of the greatest and wisest in a free republic. The monument of Humboldt was not thought to be worthy of a place in sight of the King's palace in Berlin. That was a spot consecrated to princes of the blood and military heroes. Will any American think that any ground in this country is too sacred to contain a monument to Henry?

STEPHEN THAYER OLNEY.

Stephen Thayer Olney died at Providence, his native city, on the 27th of July, 1878, at the age of sixty-six, thus reducing to a small number the list of Associate Fellows in the botanical section. Colonel Olney was for most of his life actively engaged in business, for several years at Augusta, Georgia, and afterward in Providence. But he early became fond of Botany, published a Catalogue of Rhode Island Plants in the year 1844, and two critical papers on the Botany of the State a few years later. These appeared in the Proceedings of the Providence Franklin Society, over which institution he presided for many years, taking a leading part in the development of its scientific interests. He was a keen observer, made interesting contributions to his favorite science through his correspondence with the principal botanists of his day engaged in publication, formed a large and valuable herbarium and a choice botanical library, and, selecting for special investigation the very large and difficult genus *Carex*, he had become the leading critical authority in this department. He had planned an extensive work in illustration of this genus, had begun the distribution of accurately-named specimens and the preparation of costly figures, and had entered upon the characterization of new species, in the Pro-